



MOTOROLA INC.

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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

**ORIGINAL
FILE**

October 6, 1992

Ms. Donna Searcy
Federal Communications Commission
1919 M Street, N.W.
Room 222
Washington, D.C. 20554

RE: Dockets ET 92-100 GEN 90-314 

Dear Ms. Searcy:

Representatives of Motorola met today with members of the Office of Engineering and Technology to discuss Narrowband PCS/Advanced Messaging. Two copies of written material presented are attached for the docket files.

Regards,



Stuart Overby
Manager of Regulatory Programs

No. of Copies rec'd
List A B C D E

041

MOTOROLA PAGING AND WIRELESS DATA GROUP

ADVANCED MESSAGING SERVICES (AMS)

MM 10/3/92 Rev. 0

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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

AGENDA

- I. ENHANCED APPROACH TO AMS**
- II. SPECTRUM CONSERVATION THROUGH ASYMMETRY**
- III. SPECTRALLY EFFICIENT SYSTEM PROPOSAL**
- IV. BENEFITS OF MULTI-CHANNEL LICENSES**
- V. BENEFITS OF QUIET TALK-IN SPECTRUM**
- VI. RECOMMENDED BANDPLAN**

Advanced Messaging Service

• KEY SYSTEM ATTRIBUTES

- **INBOUND SIGNALING**
 - ACKS, REQUESTS, REGISTRATION, MESSAGES
- **HIGH CAPACITY OUTBOUND MESSAGING**
 - WIDE-AREA SIMULCAST FOR:
 - BROADCAST MESSAGES (1-N)
 - LOCALIZATION (ADDRESS ONLY)
 - FREQUENCY RE-USE FOR INDIVIDUAL MESSAGING
 - ACK OF ADDRESS GIVES LOCATION
 - MESSAGE SENT IN LOCAL CELL ONLY
- **COVERAGE EQUIVALENT TO PAGING**
- **SMALL, LOW COST, LONG BATTERY LIFE
SUBSCRIBER UNITS**

MOBILE DATA

INBOUND / OUTBOUND SYMMETRY

- **MANY MOBILE DATA USES REQUIRE MORE OUTBOUND THAN INBOUND TRAFFIC CAPACITY**
- **IT IS POSSIBLE TO PURPOSELY BUILD AN ASYMMETRICAL DATA SYSTEM WHICH:**
 - **IS HIGHLY COST EFFECTIVE**
 - **MEETS THE TRAFFIC NEEDS OF MUCH OF THE MARKET**
 - **HAS SMALLER, LONGER BATTERY LIFE UNITS**
 - **IS SPECTRUM EFFICIENT**

SUCH A SYSTEM REQUIRES LESS BANDWIDTH FOR INBOUND MESSAGES THAN FOR OUTBOUND MESSAGES

PAGING

ASYMMETRICAL MESSAGES

- **NATURAL DRIVERS TOWARD ASYMMETRY**

- **INFOCAST BROADCAST SERVICES**
- **REMOTE COMPUTER DATABASES**
- **LIMITED ENTRY CAPABILITY OF SMALL DEVICES**

- **OTHER POSSIBLE DRIVERS TOWARD ASYMMETRY**

- **FORMS OR CANNED MESSAGES AT PORTABLE DEVICE
(RESIDENT OR RECEIVED VIA OUTBOUND RF)**
- **MEMORY AT CENTRAL TERMINAL TO TRACK PORTABLE**
- **WIRELINE ALTERNATIVE IN PORTABLE**
- **PRICING AND TRANSFER TIME OF INBOUND RF**

PAGING

MOBILE DATA APPLICATIONS* --- SYMMETRY

APPLICATION

- MAIL
 - ORIGINATION
 - RECEPTION
 - FORWARDING
 - ANNOTATION W/ FORWARDING
- DATA INQUIRY/RESPONSE
- INFOCAST
- LINK SESSIONS
 - PORTABLE - COMPUTER
 - PEER-PEER
- FINDER (Call me at..., Who has a ...)
- ROUTE (Where is ...)
- MALL
 - SHOPPING (Tell me about your...)
 - PURCHASE (Buy (number) @ \$ _)
- AGENT (Do this for me..Dispatch)
- SUBMIT (Take this...)

SYMMETRY

- OUTBOUND WEIGHTED OVERALL
 - DEVICE LIMITED INBOUND
 - LONG OUTBOUND DOCUMENTS
 - INBOUND = ID+ADDRESSES ONLY
 - INBOUND = ANNOT+ID+ADDR ONLY
- MOSTLY LONG OUTBOUND
- LONG OUTBOUND ONLY
- OUTBOUND WEIGHTED OVERALL
 - MOSTLY LONG OUTBOUND
 - MOSTLY SHORT SYMMETRICAL
- OUTBOUND WEIGHTED
- SYMMETRICAL?
- OUTBOUND WEIGHTED OVERALL
 - MOSTLY OUTBOUND
 - SHORT INBOUND
- MOSTLY OUTBOUND
- MOSTLY INBOUND

*From McLaughlin & Associates Inc - Mobile Communications Marketplace Pre-Convention Seminar 9/29/92

PAGING

TRAFFIC BALANCE ON "TAM" CHANNELS (W/O INFOCAST)

MIX	TYPE	TRAFFIC	LENGTH	TRAFFIC CONTRIBUTION (CHARACTERS/DAY)**	
				OUTBOUND	INBOUND
50%•	NUMERIC PAGERS (NO ACK)	2.5/DAY	10 CHAR	12.50	0.00
25%•	ALPHANUMERIC PAGERS (AUTO ACK ONLY)	3.0/DAY	80 CHAR	60.00	2.25
25%•	E-MAIL / COMPUTER UNITS (AUTO AND USER ACK + INITIATION)				
	• E-MAIL PAGE RECEPTION	5.0/DAY	500 CHAR	625.00	15.00
	• 20% REPLIES	1.0/DAY	100 CHAR	0.75	25.00
	• FILE DOWNLOADS	1.0/DAY	10K CHAR	2500.00	30.75
	• FILE TRANSFER REQUESTS	1.0/DAY	50 CHAR	0.75	12.50
	• ALPHA PAGE INITIATION	1.0/DAY	80 CHAR	20.00	0.75

* SUBMISSIONS & E-MAIL ORIGATION ASSUMED TO BE BY WIRELINE

** ACKS ASSUMED TO BE 3 CHARACTERS LONG

TOTAL	3219.00	76.25
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INBOUND = 2.4% OUTBOUND

Prepared by Paging Division
Bob Schwendeman 10/1/92

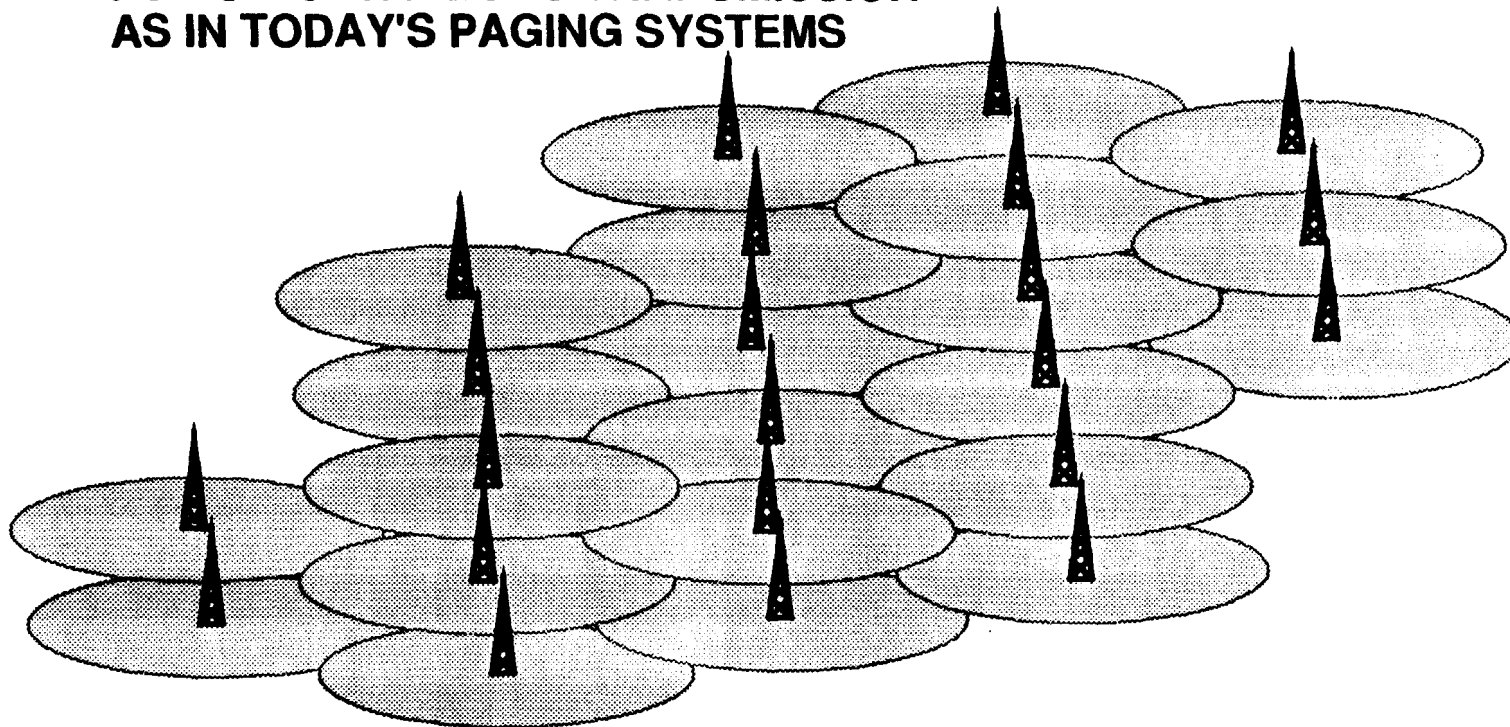
AMS = ENHANCED ONE-WAY MESSAGING

• KEY SYSTEM ATTRIBUTES

- INBOUND SIGNALING**
 - ACKS, REQUESTS, REGISTRATION, SHORT MESSAGES
- HIGH CAPACITY OUTBOUND MESSAGING**
 - WIDE-AREA SIMULCAST FOR:
 - BROADCAST MESSAGES (1-N)
 - LOCALIZATION (ADDRESS ONLY)
 - FREQUENCY RE-USE FOR INDIVIDUAL MESSAGING
 - ACK OF ADDRESS GIVES LOCATION
 - MESSAGE SENT IN LOCAL CELL ONLY
- COVERAGE EQUIVALENT TO PAGING**
- SMALL, LOW COST, LONG BATTERY LIFE
SUBSCRIBER UNITS**

OUTBOUND MESSAGE - STEP 1 BROADCAST / LOCATION VIA SIMULCAST

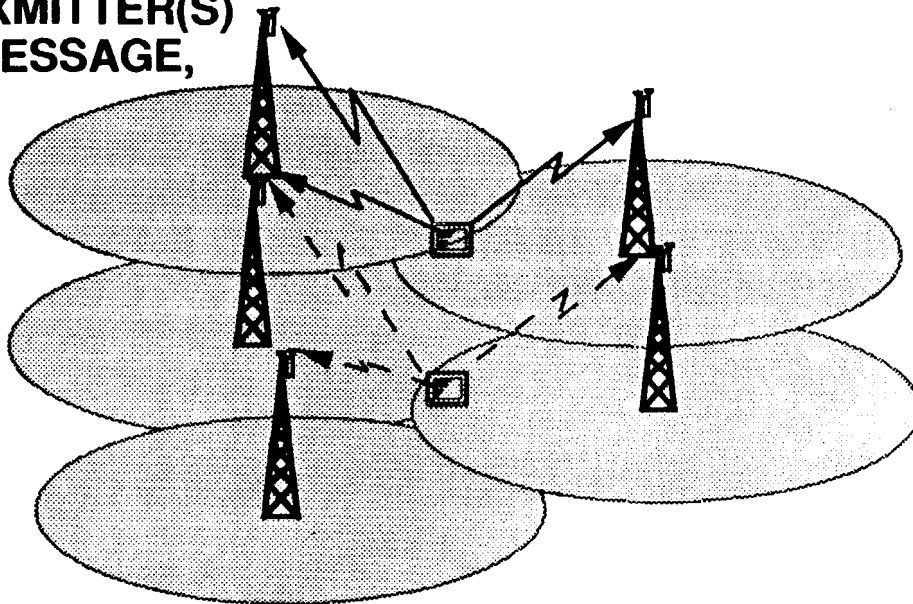
**MESSAGE SENT FROM CENTRAL CONTROLLER TO ALL SITES
FOR SIMULTANEOUS TRANSMISSION
AS IN TODAY'S PAGING SYSTEMS**



- USED FOR 1 TO N (BROADCAST) MESSAGES
- BROADCAST OF ADDRESS IS FIRST STEP IN DELIVERY OF MESSAGE TO SUBSCRIBER WHOSE LOCATION IS UNKNOWN

OUTBOUND MESSAGE TO INDIVIDUAL - STEP 2 ACK OF ADDRESS

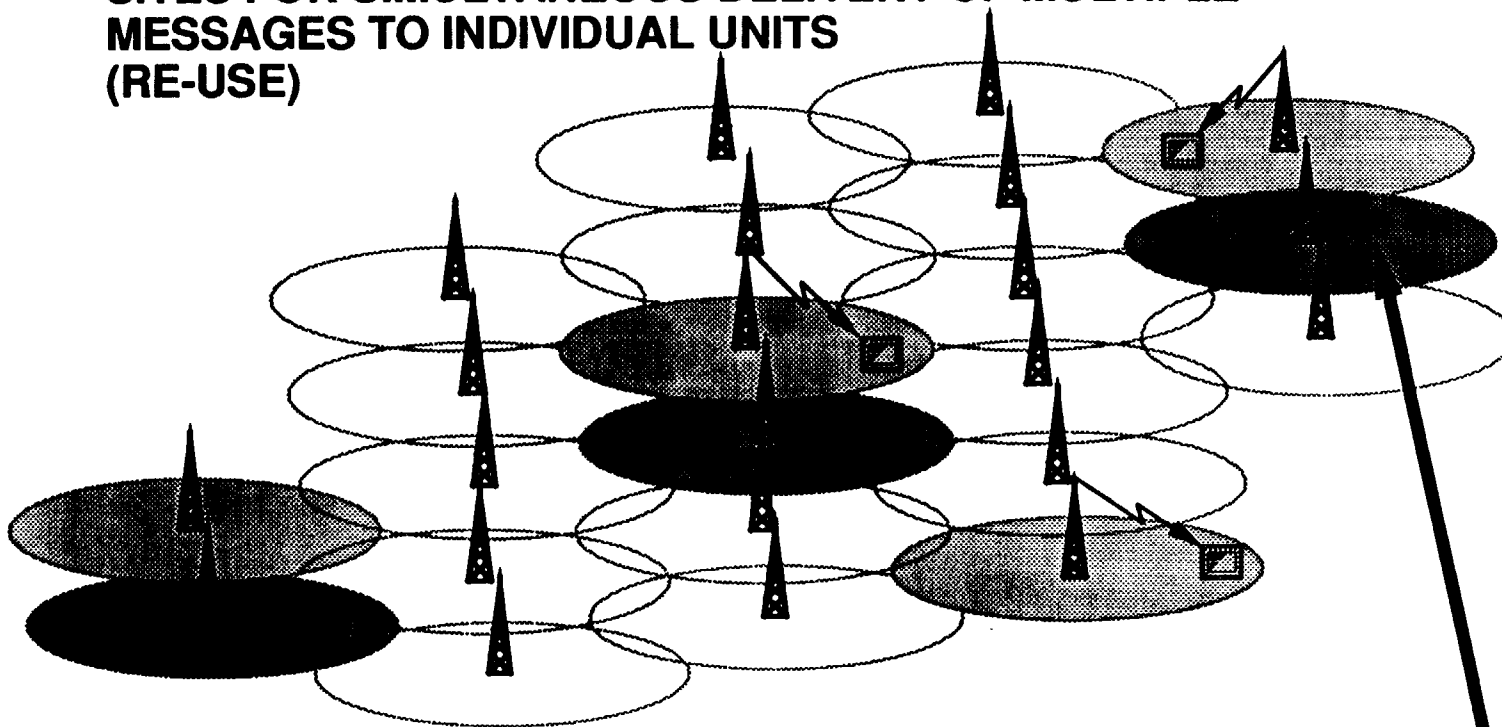
- UPON RECEIPT OF ADDRESS, UNIT RESPONDS IN UNIQUE (TIME/FREQ/CODE) CHANNEL
- MULTIPLE RECEIVE SITES LOG DATA AND SIGNAL STRENGTH
- CENTRAL CONTROLLER COLLECTS ACKS / SIGNAL STRENGTH, DETERMINES BEST XMITTER(S) FOR DELIVERY OF MESSAGE, AND SCHEDULES MESSAGE TRANSMISSION TO ACHIEVE MAXIMUM RE-USE



- MICRO AND MACRO DIVERSITY TO IMPROVE INBOUND RANGE
- NO RE-USE DURING ADDRESS ACK

OUTBOUND MESSAGE TO INDIVIDUAL - STEP 3 NON-SIMULCAST DELIVERY WITH RE-USE

MESSAGES SENT FROM CENTRAL CONTROLLER TO INDIVIDUAL
SITES FOR SIMULTANEOUS DELIVERY OF MULTIPLE
MESSAGES TO INDIVIDUAL UNITS
(RE-USE)



- TRANSMISSIONS RE-USE SAME CHANNEL IN CELLS SUFFICIENTLY SEPARATED
- ADDITIONAL CHANNELS WOULD INCREASE CAPACITY WITH SAME INFRASTRUCTURE

OUTBOUND MESSAGE TO INDIVIDUAL - SUMMARY

<u>STEP</u>	<u>ACTION</u>
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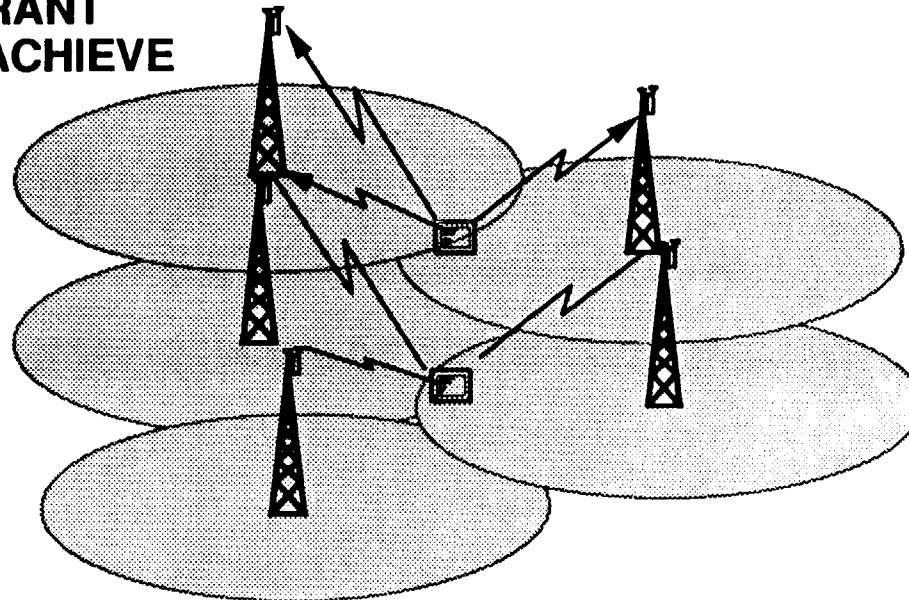
- | | |
|----------|--|
| 1 | SIMULCAST ADDRESS |
| 2 | UNIT ACKS ADDRESS (NO RE-USE) |
| 3 | MESSAGE TRANSMITTED IN LOCAL AREA (WITH RE-USE) |
| 4 | UNIT ACKS MESSAGE DATA (WITH RE-USE) |
| 5 | 3 AND 4 REPEATED IF NECESSARY DUE TO ERRORS |

OPTIONAL

- | | |
|----------|---------------------------------------|
| 6 | USER INITIATED ACK OR RESPONSE |
|----------|---------------------------------------|

INBOUND INITIATION - STEP 1 REGISTRATION, REQUEST, ASYNC RESPONSE, ETC.

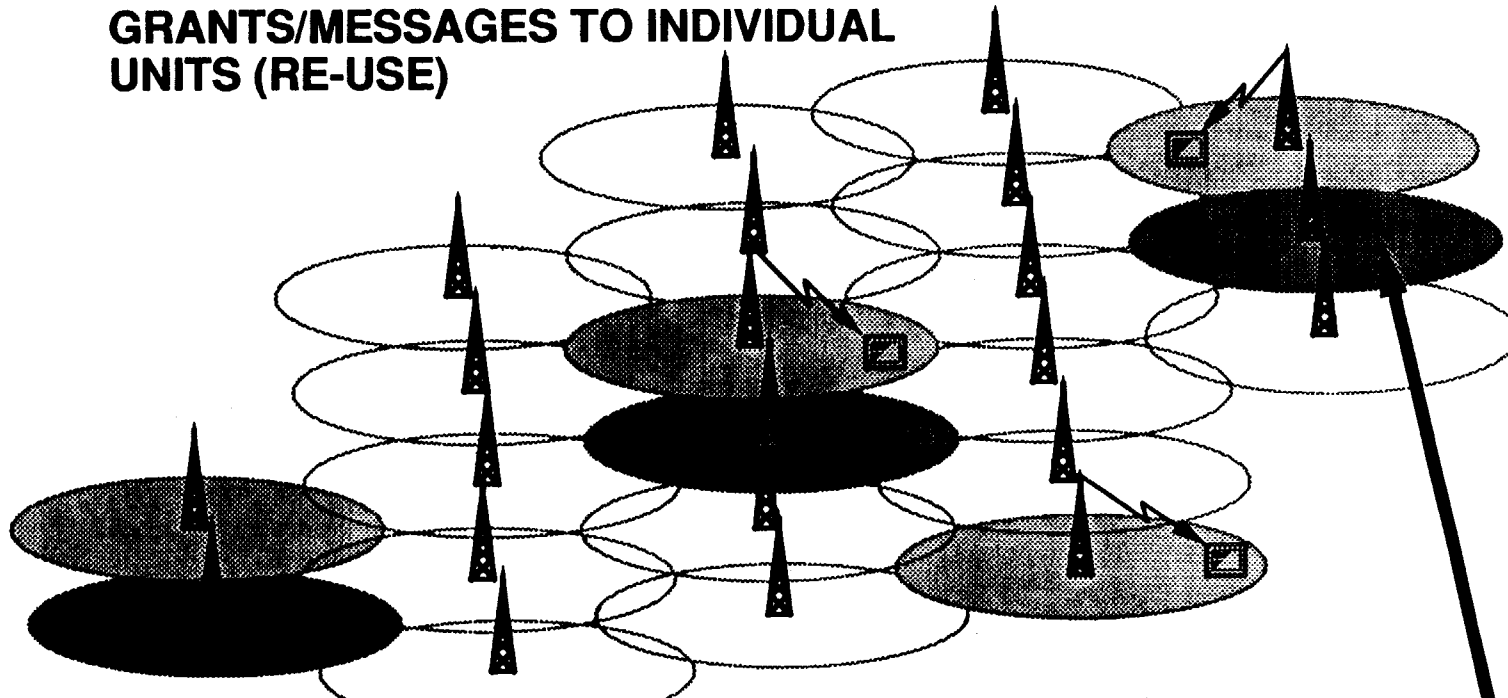
- UNIT TRANSMITS SHORT REQUEST FOR SERVICE
- MULTIPLE RECEIVE SITES LOG DATA AND SIGNAL STRENGTH
- CENTRAL CONTROLLER COLLECTS DATA / SIGNAL STRENGTH, DETERMINES BEST XMITTER(S) FOR DELIVERY OF GRANT, AND SCHEDULES GRANT TRANSMISSION TO ACHIEVE MAXIMUM RE-USE



- MICRO AND MACRO DIVERSITY TO IMPROVE INBOUND RANGE
- RE-USE AND/OR COLLISION MAY OCCUR - COLLISION RESOLVED BY RE-TRY

INBOUND INITIATION - STEP 2 CHANNEL GRANT / ASSIGN

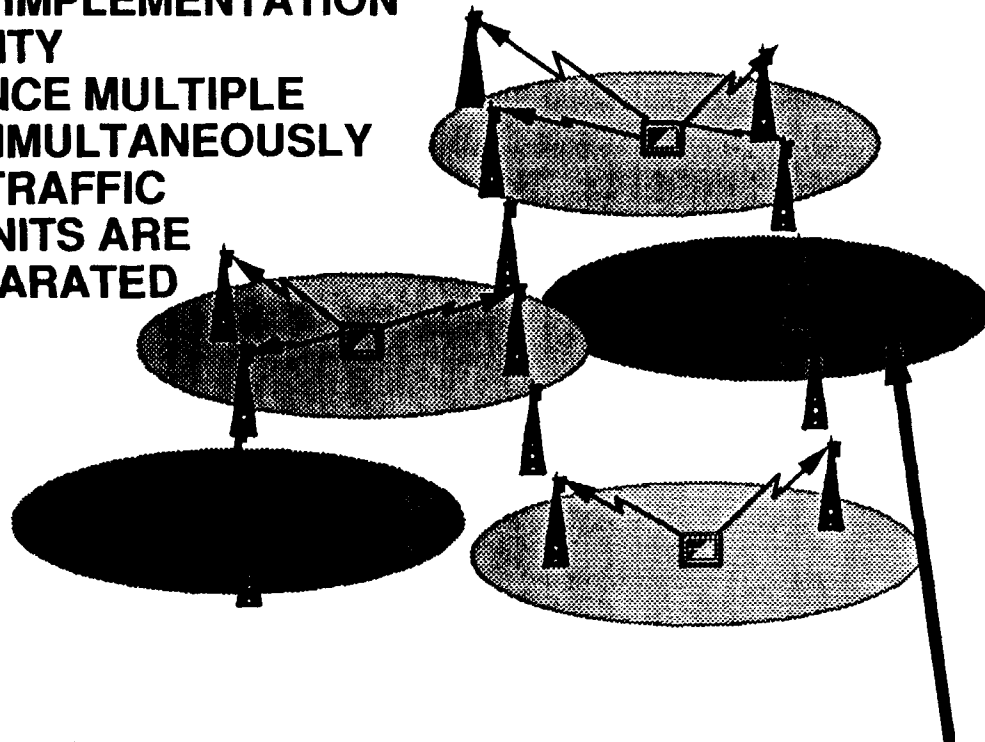
**GRANTS SENT FROM CENTRAL CONTROLLER TO INDIVIDUAL SITES
FOR SIMULTANEOUS DELIVERY OF MULTIPLE
GRANTS/MESSAGES TO INDIVIDUAL
UNITS (RE-USE)**



- SAME AS STEP 3 FOR OUTBOUND MESSAGE
- TRANSMISSIONS RE-USE SAME CHANNEL IN CELLS SUFFICIENTLY SEPARATED
- ADDITIONAL CHANNELS WOULD INCREASE CAPACITY WITH SAME INFRASTRUCTURE

INBOUND INITIATION - STEP 3 INBOUND DATA TRANSMISSION

- INBOUND DATA RECEIVED AT MULTIPLE SITES
- SITES RELAY DATA AND SIGNAL STRENGTH TO CENTRAL CONTROLLER FOR IMPLEMENTATION OF MACRO DIVERSITY
- RE-USE ACHIEVED SINCE MULTIPLE UNITS TRANSMIT SIMULTANEOUSLY IN AREAS WHERE TRAFFIC IS PENDING AND UNITS ARE SUFFICIENTLY SEPARATED



- ADDITIONAL CHANNELS WOULD INCREASE CAPACITY WITH SAME INFRASTRUCTURE

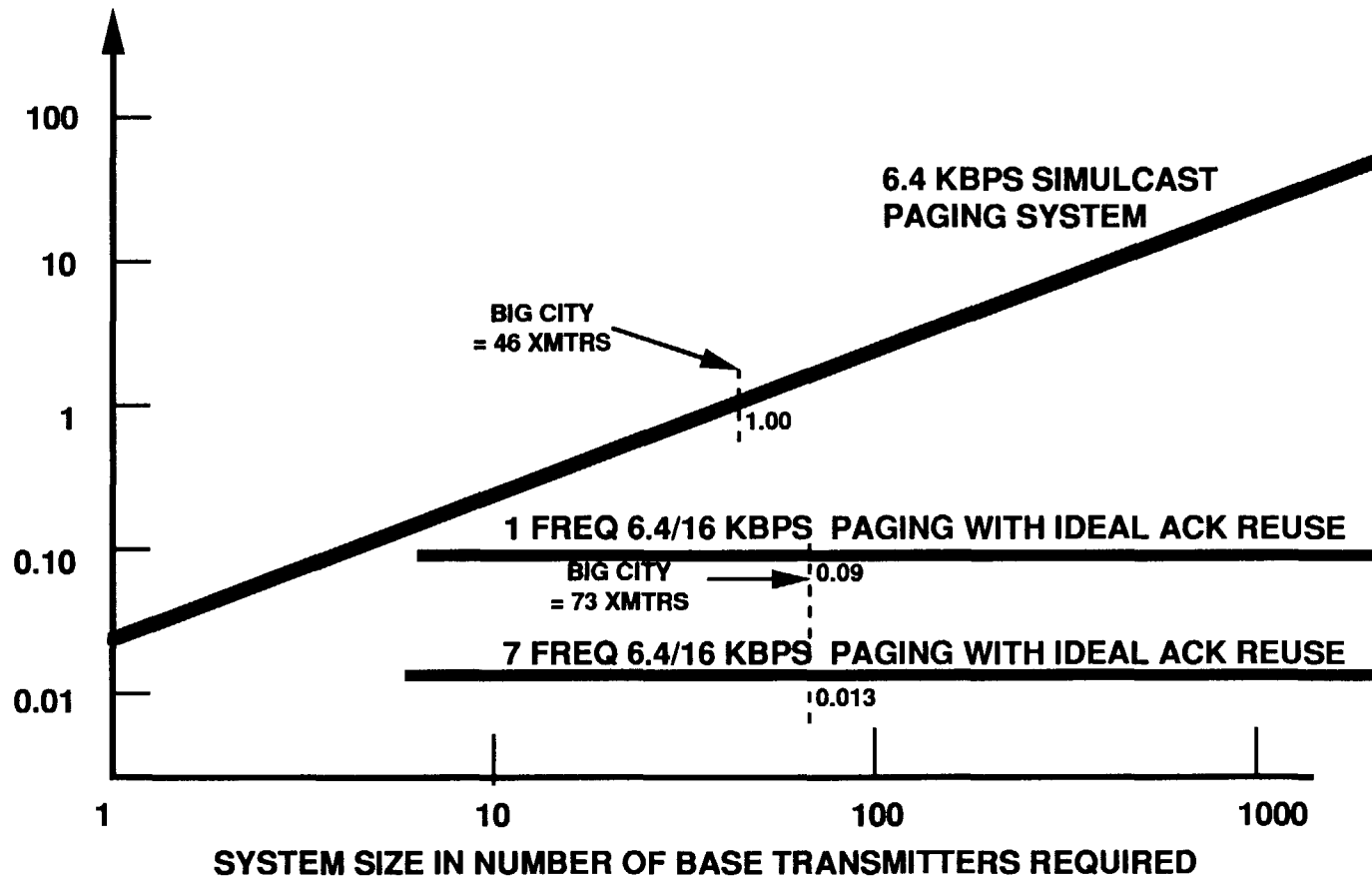
INBOUND INITIATION - SUMMARY

<u>STEP</u>	<u>ACTION</u>
1	INBOUND CHANNEL REQUEST (RE-USE)
2	OUTBOUND GRANT / ASSIGN (RE-USE)
3	INBOUND MESSAGE TRANSMISSION
4	OUTBOUND CONFIRMATION (RE-USE - LIKE 2)
5	3 AND 4 REPEATED IF NECESSARY DUE TO ERRORS

PAGING WITH ACK

RF SYSTEM COST PER MILLION BITS VS SYSTEM SIZE

RELATIVE COST PER
MILLION BITS DELIVERED



Band Plan Objectives

To provide asymmetrical and symmetrical pairs to conserve spectrum.

To take advantage of the quiet 901-902 MHz "talk in" band for low cost system design.

To provide additional nationwide operators.

Pairing plan for all talk out channels.

To provide "talk in " channels to allow existing operators to upgrade.

To recognize that paging has progressed to regional operation. (no local allocations)

901-902 MHZ FOR INBOUND

- **INBOUND CHANNELS NEED QUIET SPECTRUM**
 - TWO-WAY USES PAIRED SPECTRUM FOR GOOD REASON
 - COST IMPACT IS EVEN WORSE WITH HIGH POWER PAGING

INBOUND QUIET CHANNEL COST IMPACT			
FREQ. BAND	901-902	930-931	COST
# RCV SITES	40	400	360
RECURRING MONTHLY COSTS			
SITE RENTAL	\$8,000	\$80,000	\$72,000
LINE COSTS	\$6,000	\$60,000	\$54,000
TOTAL	\$14,000	\$140,000	\$126,000
*BASED UPON 20 DB DEGRADATION IN ACK RECEIVER SENSITIVITY DUE TO A SINGLE ADJACENT CHANNEL			
1000W TRANSMITTER 1 MILE AWAY			

STRAWMAN BAND PLAN M-50/150 kHz Channels.



TALK OUT

Regional
Asymmetrical

Nationwide
Symmetrical



940-941 MHz.

3, 150 kHz Channels
11, 50 kHz Channel

TALK OUT

Regional
Asymmetrical

Nationwide
Asymmetrical

MTEL



930-931 MHz.

20, 50 kHz. Channels

ACKNOWLEDGE/TALK IN

Regional & Nationwide
Asymmetrical

Nationwide
Symmetrical



901-902 MHz.

44, 12.5 kHz. Channels
31 paired with talk out,
13 available for existing
systems.

3, 150 kHz Channels

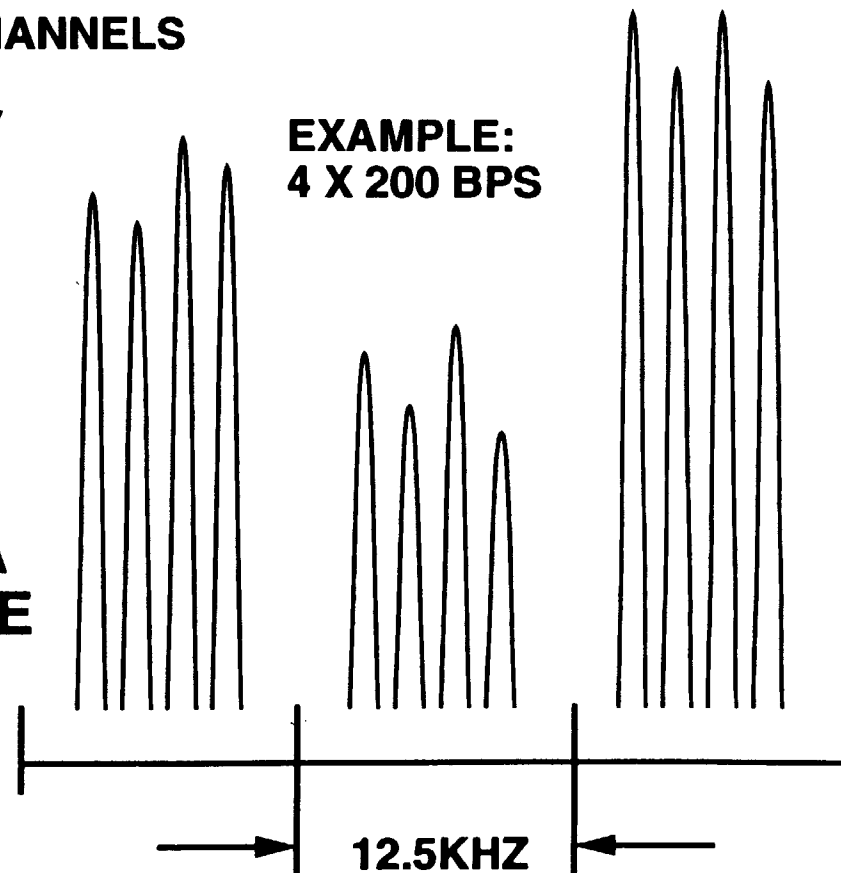


12.5 kHz
Channels

All licensees at 930-931 automatically receive one of these channels. MTEL due to their pioneer preference status, may have a problem here.

INBOUND CHANNEL ISSUES

- LOW BIT RATE, NARROW CHANNELS
MAXIMIZE RANGE
- MAXIMUM PACKING DENSITY
IMPACTS SUBSCRIBER
UNIT SIZE, COST, AND
POWER CONSUMPTION
- REQUIRES PRECISE POWER
CONTROL
- REQUIRES FREQUENCY
STABILITY
- 12.5 KHZ PROVIDES A
GOOD COMPROMISE
OF CAPACITY AND
FLEXIBILITY vs
IMPLEMENTATION
COMPLEXITY



ASYMMETRIC SYSTEM IS AN ENABLER

ASYMMETRIC SYSTEM

50 KHZ OUTBOUND

64 KBPS @1000W

128 KBPS @1000W

12.5 KHZ INBOUND

800 BPS @ 1W

SIMULCAST

NON-SIMULCAST

36 XMIT / 85 RCV

SITES FOR COVERAGE:

SYMMETRIC SYSTEM

50 KHZ OUTBOUND

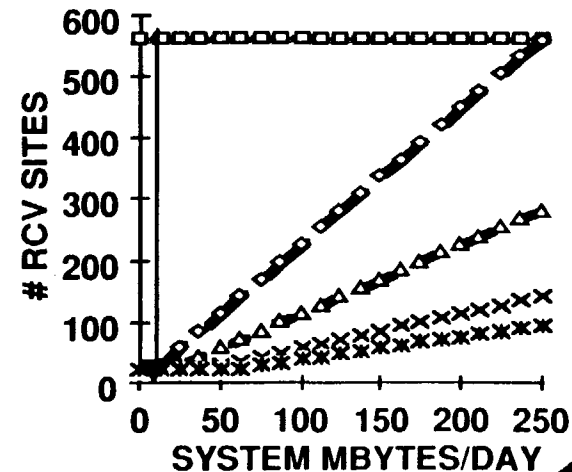
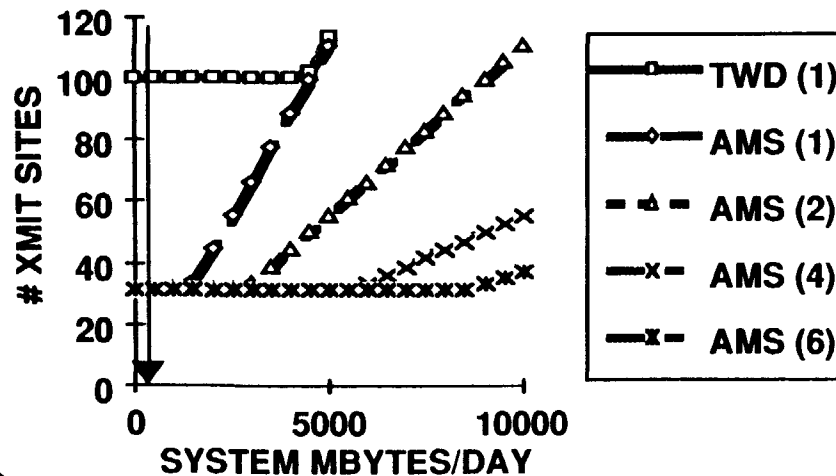
128 KBPS @100W

50 KHZ INBOUND

128 KBPS @1W

100 XMIT / 563 RCV

• LOW COST FOR INITIAL COVERAGE - SYSTEM GROWS TO MEET DEMAND



CONCLUSIONS

- **FOR MUCH OF ADVANCED MESSAGING,
TALK-IN TRAFFIC << TALK-OUT TRAFFIC**
- **TALK-IN CAPABILITY ENABLES RE-USE ON OUTBOUND CHANNELS**
- **QUIET TALK-IN CHANNELS MINIMIZE INFRASTRUCTURE COST**
- **AN ASYMMETRICAL PORTION OF BANDPLAN:**
 - **MATCHES INBOUND SPECTRUM TO CAPACITY REQUIRED,
LEAVING MORE SPECTRUM FOR OUTBOUND CHANNELS**
 - **ENABLES PAIRING (RE-USE) ON MORE OUTBOUND CHANNELS**
- **A SYMMETRICAL PORTION OF THE BANDPLAN WITH WIDE
BANDWIDTH ALLOWS HIGH SPEED SIGNALLING**
- **MULTI-CHANNEL LICENSES IMPROVE SYSTEM CAPACITY WITH
MINIMAL INCREASE IN INFRASTRUCTURE, FOR LOWER COST**